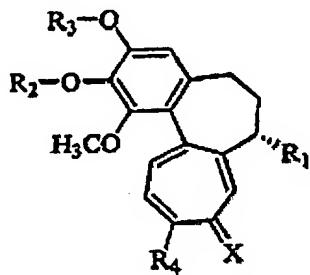


What is claimed is

1. A tricyclic derivative represented by the following <Formula 1> or pharmaceutically acceptable salts thereof.

5

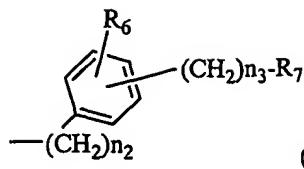
<Formula 1>



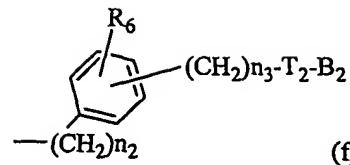
(Wherein,

(1) R₁ is -T₁-B₁;

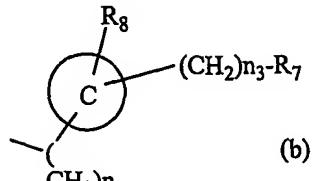
10 in which T₁ is -X₁-, -X₁-C(X₂)-, -N(R₅)-, -N(R₅)C(X₂)-, -N(R₅)S(O)n₁-, -N(R₅)C(O)-X₁- or -N(R₅)C(X₁)NH-, in that X₁ and X₂ are each O or S, R₅ is each H or C₁~C₅ alkyl group, n₁ is an integer of 1~2; and B₁ is selected from a group consisting of following (a) ~ (j),



(a)



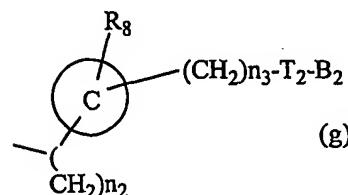
(f)



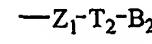
(b)



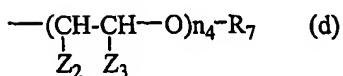
(c)



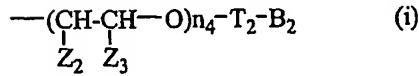
(g)



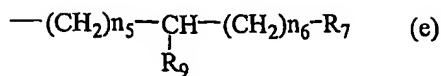
(h)



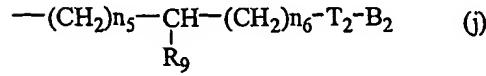
(d)



(i)

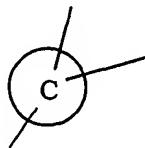


(e)

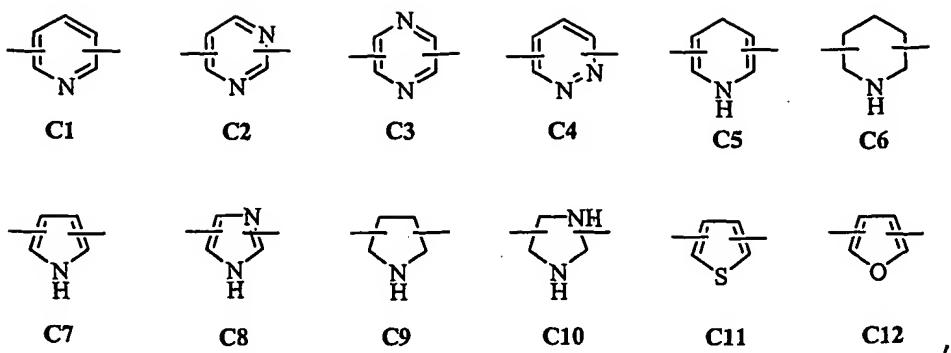


(j)

Wherein, R₆ and R₈ are each H, halogen, hydroxy, C₁~C₃ alkoxy, amino, nitro, cyano or C₁~C₃ lower alkyl group; R₇ and R₉ are each independently halogen, hydroxy, mercapto, -ONO, -ONO₂ or SNO, in which R₇ and R₉ are same or different;



is C₅~C₆ membered saturated or unsaturated heterocyclic ring containing 1~2 of hetero atom, in which the hetero atom is selected from a group consisting of O, S and N, preferably,



more preferably, C1 (pyridyl group) substituted at position 2 and 6 or position 2 and 5, C7 (pyrrolyl group) substituted at position 2 and 5 or position 2 and 4, C11 (thiophenyl group) or C12 (furanyl group); Z₁ is C₁~C₁₀ straight-chain or branched-chain alkyl group, preferably C₂~C₅ straight-chain or branched-chain alkyl group or cycloalkyl group having substituent; Z₂ and Z₃ are each independently H or methyl group, in which Z₃ is H when Z₂ is methyl group, Z₂ is H when Z₃ is methyl group; T₂ is -X₁- or -X₁-C(X₂)-, in that X₁ and X₂ are each independently O or S; B₂ is selected from a group consisting of said (a), (b), (c), (d) or (e); n₂ is an integer of 0~3, n₃ is an integer of 0~5, n₄ is an integer of 1~5, n₅ and n₆ are each independently an integer of 1~6;

(2) R₂ and R₃ are each independently H, -PO₃H₂, phosphonate, sulfate, C₃~C₇ cycloalkyl, C₂~C₇ alkenyl, C₂~C₇ alkynyl, C₁~C₇ alkanoyl, C₁~C₇ straight-chain or branched-chain alkyl or sugar, in which sugar is a

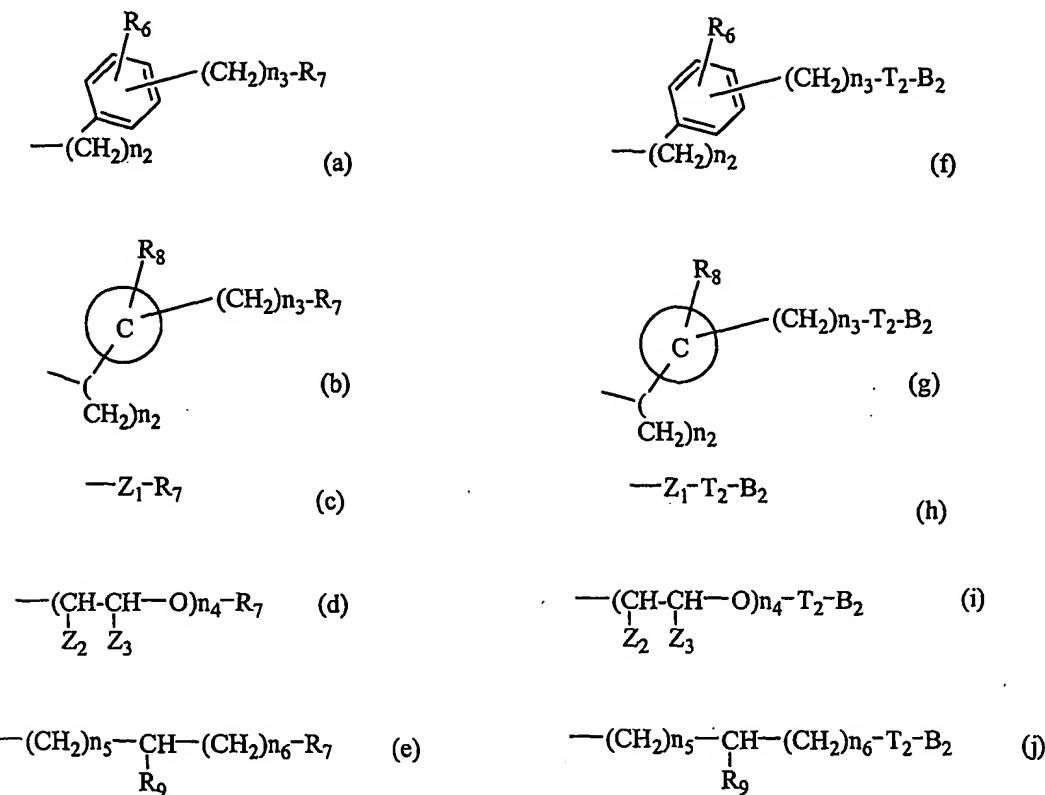
monosaccharide such as glucuronyl, glucosyl or galactosyl;

(3) R_4 is OCH_3 , SCH_3 or $NR_{10}R_{11}$, in which R_{10} and R_{11} are each independently H or C_{1-5} alkyl;

5 (4) X is O or S.).

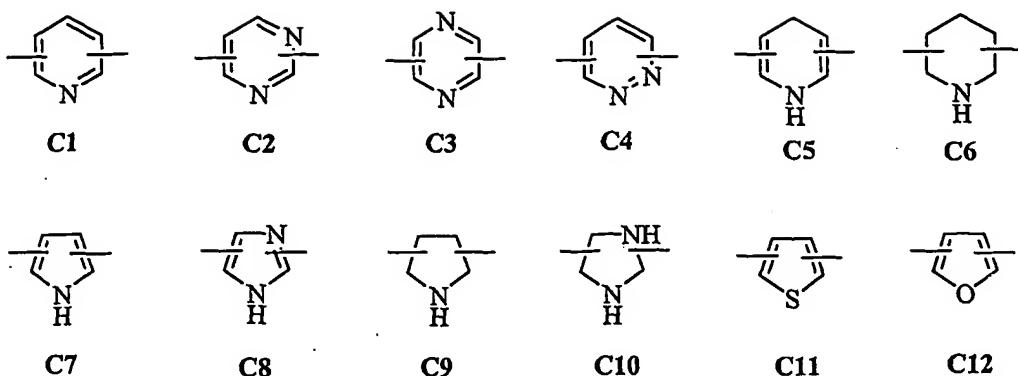
2. The tricyclic derivative or pharmaceutically acceptable salts thereof as set forth in claim 1, wherein the compound of <Formula 1> is
10 characterized as follows:

(1) R_1 is $-T_1-B_1$;
in which T_1 is $-N(R_5)C(X_2)-$, $-N(R_5)C(O)-X_1-$ or $-N(R_5)C(X_1)NH-$, in that X_1 and X_2 are each O, R_5 is each H or C_1-C_5 alkyl group; and B_1 is selected from a group
15 consisting of following (a) ~ (j),



Wherein, R_6 and R_8 are each H, halogen, hydroxy, $C_1 \sim C_3$ alkoxy, amino, nitro, cyano or $C_1 \sim C_3$ lower alkyl group; R_7 and R_9 are each independently halogen, hydroxy, mercapto(thiol), $-ONO$, $-ONO_2$ or SNO , in which R_7 and R_9 are same or different;

is $C_5 \sim C_6$ membered saturated or unsaturated heterocyclic ring containing 1~2 of hetero atom, in which the hetero atom is selected from a group consisting of O, S and N, preferably,



more preferably, C1 (pyridyl group) substituted at position 2 and 6 or position 2 and 5, C7 (pyrrolyl group) substituted at position 2 and 5 or position 2 and 4, C11 (thiophenyl group) or C12 (furanyl group), a bond of substituents may be at symmetrical or asymmetrical position; Z₁ is C₁~C₁₀ straight-chain or branched-chain alkyl group, preferably C₂~C₅ straight-chain or branched-chain alkyl group or cycloalkyl group having substituent; Z₂ and Z₃ are each independently H or methyl group, in which Z₃ is H when Z₂ is methyl group, Z₂ is H when Z₃ is methyl group; T₂ is -X₁- or -X₁-C(X₂)-, in that X₁ and X₂ are each O or S; B₂ is selected from a group consisting of said (a), (b), (c), (d) or (e); n₂ is an integer of 0~3, n₃ is an integer of 0~5, n₄ is an integer of 1~3, n₅ and n₆ are each independently an integer of 1~3;

(2) R₂ and R₃ are each independently C₃~C₇ cycloalkyl or C₁~C₇ alkyl;

20 (3) R₄ is SCH₃ or OCH₃;

(4) X is O or S.

3. The tricyclic derivative or pharmaceutically acceptable salts thereof as set forth in claim 1,
5 wherein the tricyclic derivative comprises:

- 1) 6-nitrooxymethyl-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-nicotineamide;
- 2) 5-nitrooxymethyl-furan-2-carboxylic acid-
10 [(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-amide;
- 3) N-[(7S)-3-isopropoxy-1,2-dimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-3-nitrooxymethyl-benzamide;
- 15 4) N-[(7S)-3-ethoxy-1,2-dimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-3-nitrooxymethyl-benzamide;
- 5) 6-nitrooxymethyl-pyridine-2-carboxylic acid-
10 [(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-amide;
- 6) 5-nitrooxymethyl-thiophene-2-carboxylic acid-
10 [(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-amide;

7) N- [(7S)-3-cyclopentyloxy-1,2-dimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl]-3-nitrooxymethyl-benzamide;

8) N- [(7S)-3-ethoxy-1,2-dimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl]-2-fluoro-3-nitrooxymethyl-benzamide;

9) 2-fluoro-N- [(7S)-3-isopropoxy-1,2-dimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl]-3-nitrooxymethyl-benzamide;

10) 2-fluoro-3-nitrooxymethyl-N- [(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl]-benzamide;

11) N- [(7S)-3-cyclopentyloxy-1,2-dimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl]-2-fluoro-3-nitrooxymethyl-benzamide;

12) 3-fluoro-5-nitrooxymethyl-N- [(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl]-benzamide;

13) N- [(7S)-3-ethoxy-1,2-dimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl]-3-fluoro-5-nitrooxymethyl-benzamide;

14) 3-fluoro-N-[(7S)-3-isopropoxy-1,2-dimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-5-nitrooxymethyl-benzamide;

15) N-[(7S)-3-cyclopentyloxy-1,2-dimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-3-fluoro-5-nitrooxymethyl-benzamide;

16) 4-fluoro-3-nitrooxymethyl-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-benzamide;

17) 2-fluoro-5-nitrooxymethyl-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-benzamide;

18) 3-hydroxy-5-nitrooxymethyl-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-benzamide;

19) 3,5-bis-nitrooxymethyl-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-benzamide;

20) 2-hydroxy-4-nitrooxymethyl-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-benzamide;

21) 4-nitrooxymethyl-thiophene-2-carboxylic acid [(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-amide;

22) 3-nitrooxymethyl-thiophene-2-carboxylic acid [(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo [a] heptalen-7-yl]-amide;

23) 2-(3-nitrooxymethyl-phenyl)-N-[(7S)-1,2,3-5 trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo [a] heptalen-7-yl]-acetamide;

24) 3-(2-nitrooxy-ethyl)-N-[(7S)-1,2,3- trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo [a] heptalen-7-yl]-benzamide;

10 25) 3-nitrooxybenzoic acid-5-[(7S)-1,2,3- trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo [a] heptalen-7-yl-carbamoyl]-pyridine-2-yl-methylester;

15 26) 4-nitrooxybutyric acid-5-[(7S)-1,2,3- trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo [a] heptalen-7-yl-carbamoyl]-pyridine-2-yl-methylester;

20 27) 3-nitrooxymethyl-benzoic acid-6-[(7S)-1,2,3- trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo [a] heptalen-7-yl-carbamoyl]-pyridine-2-yl-methylester;

25 28) 4-nitrooxybutyric acid-6-[(7S)-1,2,3- trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo [a] heptalen-7-yl-carbamoyl]-pyridine-2-yl-methylester;

29) 3-nitrooxymethyl-benzoic acid-2-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl-carbamoyl]-phenylester;

30) 4-nitrooxybutyric acid-2-[(7S)-1,2,3-5 trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl-carbamoyl]-phenylester;

31) 3-nitrooxymethyl-benzoic acid-3-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl-carbamoyl]-phenylester;

10 32) 4-nitrooxybutyric acid-3-[(7S)-1,2,3- trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl-carbamoyl]-phenylester;

33) 3-nitrooxymethyl-benzoic acid-3-[(7S)-1,2,3-15 trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl-carbamoyl]-benzylester;

34) 4-nitrooxybutyric acid-3-[(7S)-1,2,3- trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl-carbamoyl]-benzylester;

35) 2-nitrosothio-N-[(7S)-1,2,3-trimethoxy-10-20 methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl]-benzamide;

36) 3-nitrosooxymethyl-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydrobenzo[a]heptalen-7-yl]-benzamide;

37) 3-fluoro-5-nitrosooxymethyl-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-benzamide;

38) 3-nitrosothiomethyl-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-benzamide;

39) 3-fluoro-5-nitrosothiomethyl-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-benzamide;

40) 3-fluoro-5-nitroooxymethyl-N-[(7S)-1,2,3,10-tetramethoxy-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-benzamide;

41) 3-nitroooxymethyl-N-methyl-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-benzamide;

42) 3-fluoro-N-methyl-5-nitroooxymethyl-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-benzamide;

43) 2-(3-fluoro-5-nitroooxymethyl-phenyl)-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-acetamide; or

44) 2-(2-fluoro-5-nitroooxymethyl-phenyl)-N-[(7S)-1,2,3-trimethoxy-10-methylsulfanyl-9-oxo-5,6,7,9-tetrahydro-benzo[a]heptalen-7-yl]-acetamide.

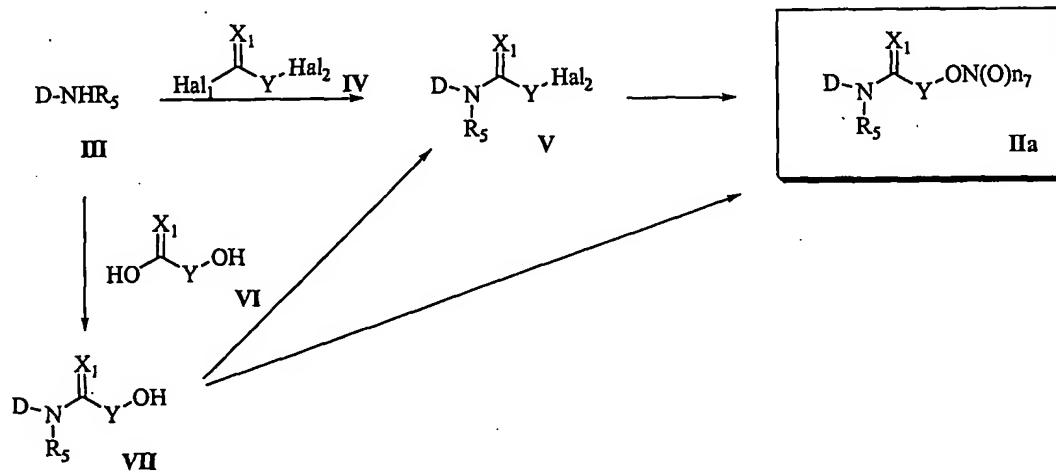
4. A method for preparing tricyclic derivatives as represented in <Scheme 1> comprising the following steps:

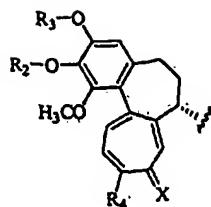
5 (1) Reaction of the compound of formula (III) with the compound formula (IV) or the compound of formula (VI) is performed to give the compound of formula (V) or the compound of formula (VII), or reaction of the resultant compound of formula (VII) with the halogen compound is performed to give the compound of formula (V) (Step 1); and

10 (2) Nitration or nitrosation of the prepared compound of formula (V) or the compound of formula (VII) is performed to give the compound of formula (IIa) (Step 2).

15

<Scheme 1>

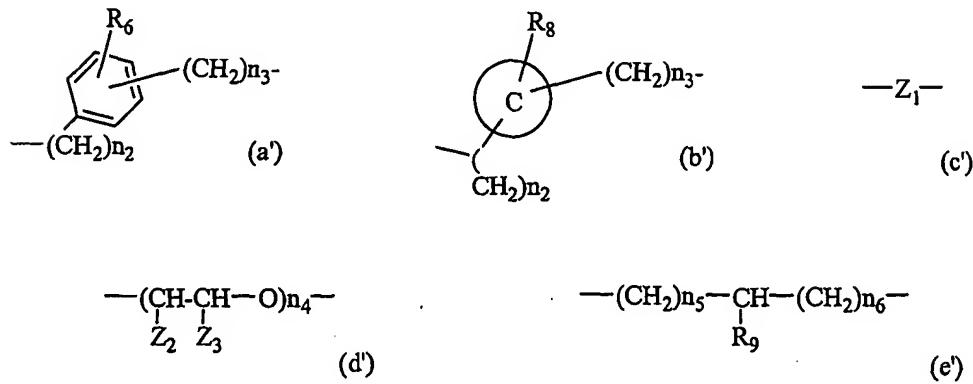




(Wherein, D is , and R₂, R₃, R₄ and X

are same as defined in the <Formula 1>;

R₅ is H or low molecular weight alkyl; X₁ is O or S; Hal₁ and Hal₂ are halogens; Hal₁ and Hal₂ of 5 general formula (IV) and (IX) are each same or different halogens, for example F, Cl, Br or I; Y indicates general formula (a'), (b'), (c'), (d') and (e') respectively,



10

Wherein, , R₆, R₈, R₉, Z₁, Z₂, Z₃, n₂, n₃, n₄, n₅ and n₆ are same as defined in the <Formula 1>.)

5. An anticancer agent or anti-proliferation agent containing tricyclic derivatives of any one of claim 1 - claim 3 or pharmaceutically acceptable salts thereof as an effective ingredient.

5

6. An angiogenesis inhibitor containing tricyclic derivatives of any one of claim 1 - claim 3 or pharmaceutically acceptable salts thereof as an effective ingredient.